US009354769B1

(12) **United States Patent**
Kudva et al.

(10) **Patent No.: US 9,354,769 B1**
(45) **Date of Patent: May 31, 2016**

(54) **ELECTRONICALLY CONTROLLING COMMITMENT OF A CHANGE TO STORED INFORMATION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1067 days.

(21) Appl. No.: **13/077,175**

(22) Filed: **Mar. 31, 2011**

(51) **Int. Cl.**
G06F 3/0481 (2013.01)
H04L 12/18 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 3/0481*** (2013.01); ***H04L 12/1822*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 3/0481; G06F 3/023; H04L 12/1822
USPC 715/751–756, 758–759, 761–763, 715/748–749; 707/108; 719/314; 717/101, 717/106
See application file for complete search history.

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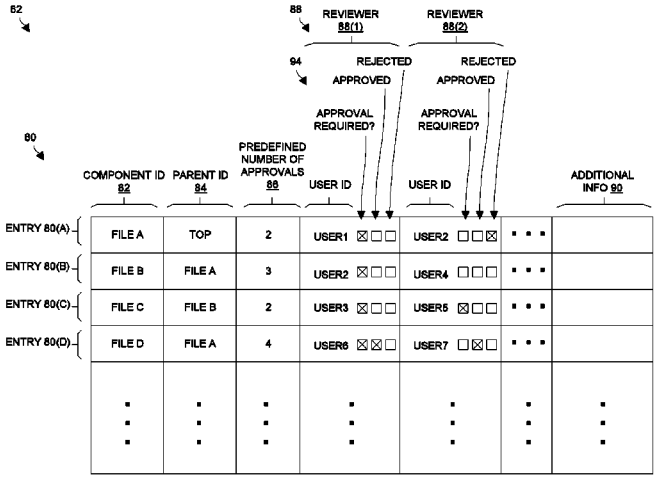
(74) *Attorney, Agent, or Firm* — BainwoodHuang

(57) **ABSTRACT**

A technique electronically controls commitment of a change to stored information. The technique involves accessing a reviewer database to ascertain a set of reviewers assigned to review proposed changes to the stored information. The technique further involves electronically notifying the set of reviewers to review a particular proposed change to the stored information after the set of reviewers is ascertained. Each reviewer is able to electronically approve or reject the particular proposed change to the stored information. The technique further involves (i) electronically preventing commitment of the particular proposed change to the stored information while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enabling commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers.

24 Claims, 5 Drawing Sheets



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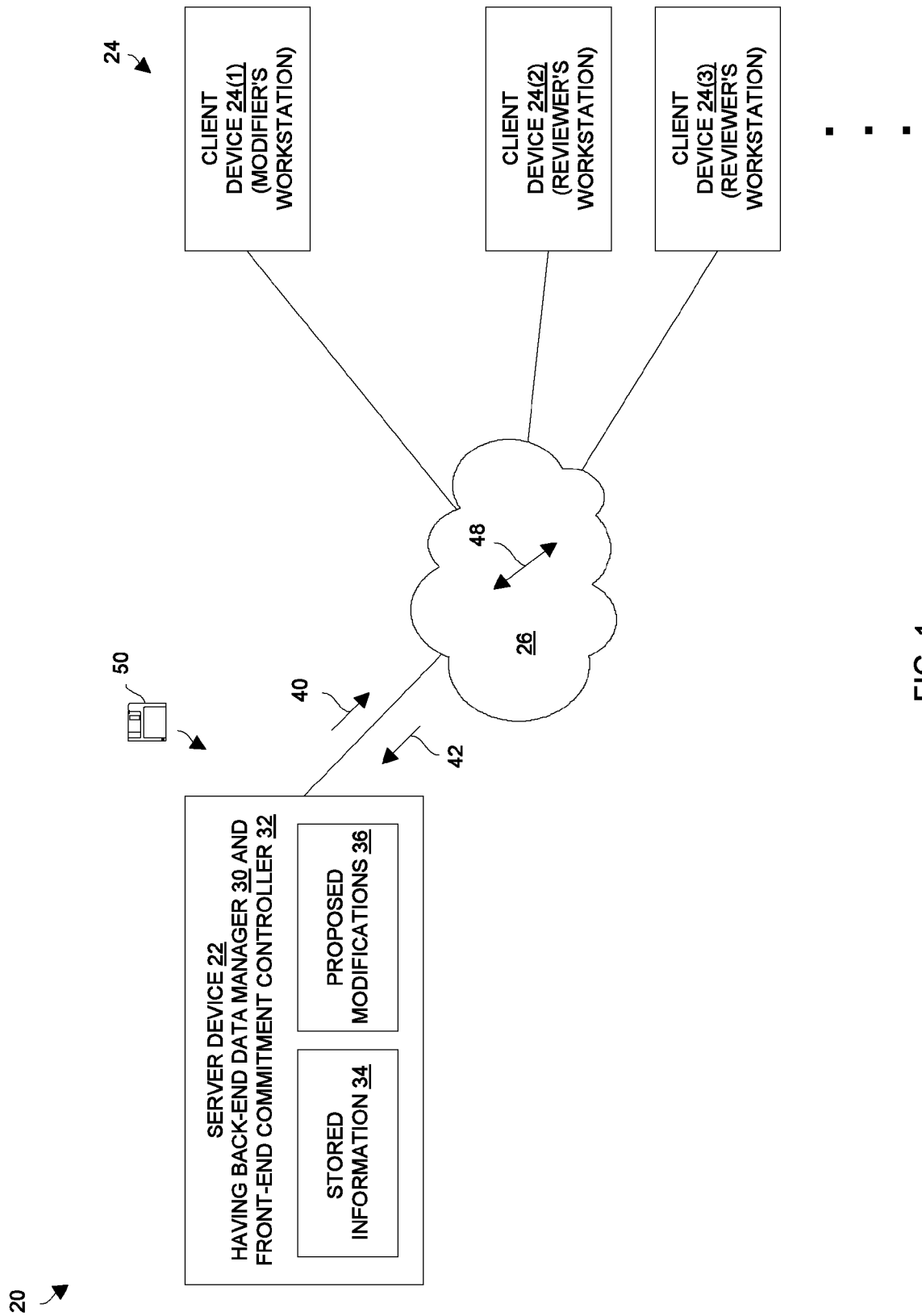
20
24
CLIENT DEVICE 24(1) (MODIFIER'S WORKSTATION)
CLIENT DEVICE 24(2) (REVIEWER'S WORKSTATION)
CLIENT DEVICE 24(3) (REVIEWER'S WORKSTATION)
48
26
50
40
42
SERVER DEVICE 22
HAVING BACK-END DATA MANAGER 30 AND FRONT-END COMMITMENT CONTROLLER 32
STORED INFORMATION 34
PROPOSED MODIFICATIONS 36

FIG. 1

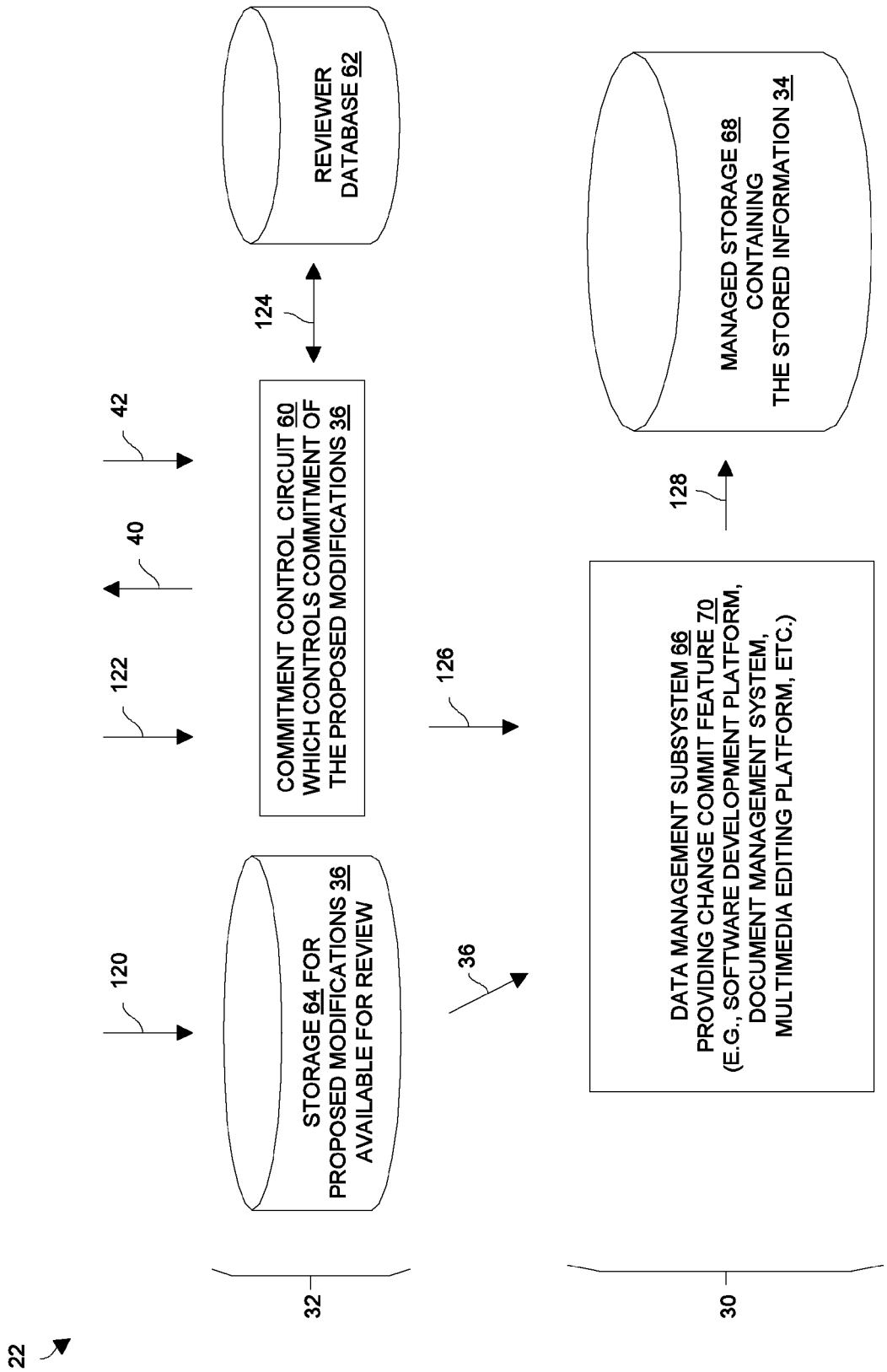
22
32
30
36
120
122
40
42
124
126
128
STORAGE 64 FOR PROPOSED MODIFICATIONS 36 AVAILABLE FOR REVIEW
COMMITMENT CONTROL CIRCUIT 60 WHICH CONTROLS COMMITMENT OF THE PROPOSED MODIFICATIONS 36
REVIEWER DATABASE 62
DATA MANAGEMENT SUBSYSTEM 66 PROVIDING CHANGE COMMIT FEATURE 70 (E.G., SOFTWARE DEVELOPMENT PLATFORM, DOCUMENT MANAGEMENT SYSTEM, MULTIMEDIA EDITING PLATFORM, ETC.)
MANAGED STORAGE 68 CONTAINING THE STORED INFORMATION 34

FIG. 2

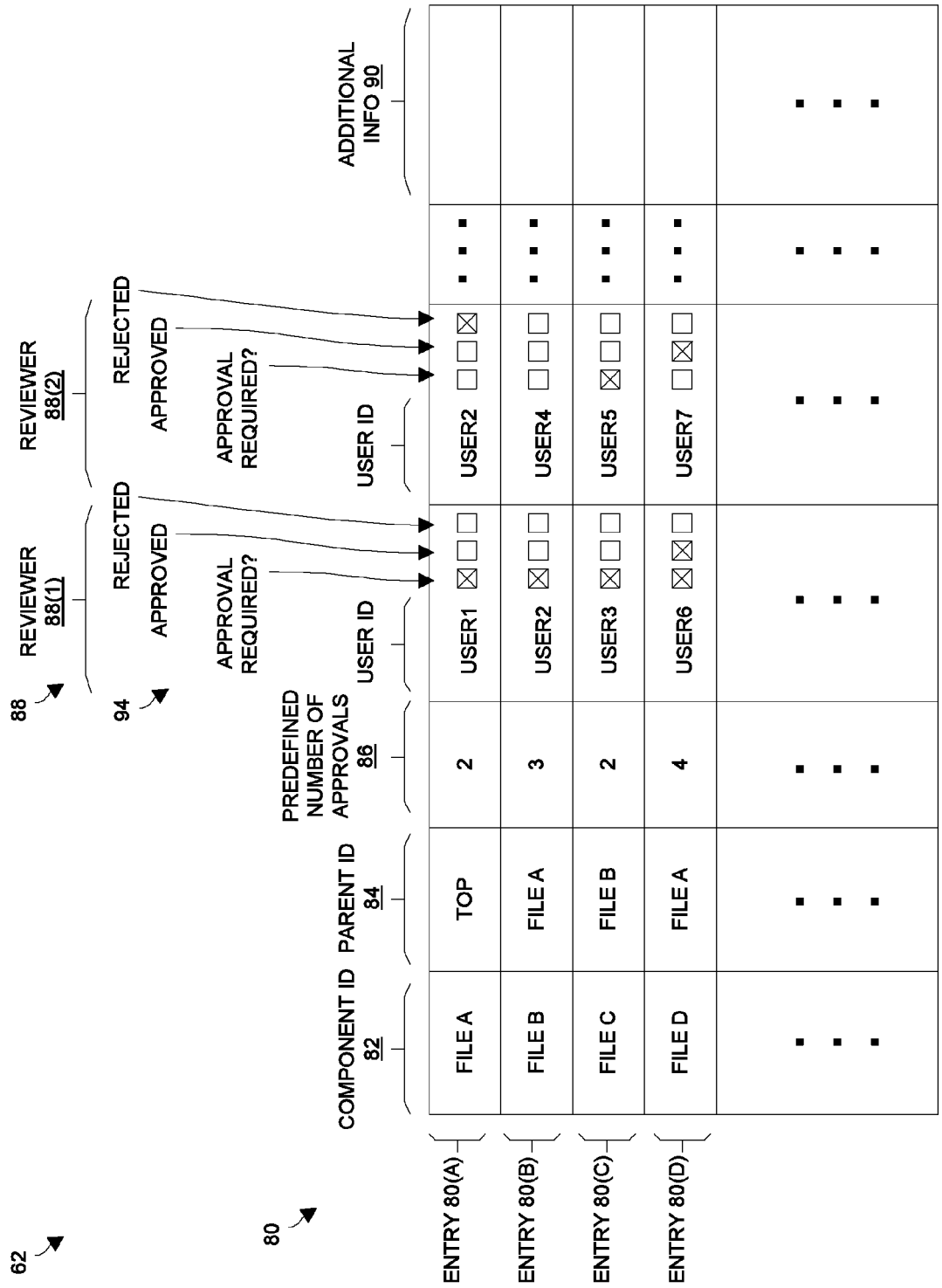
62
80
ENTRY 80(A)
ENTRY 80(B)
ENTRY 80(C)
ENTRY 80(D)
COMPONENT ID 82
PARENT ID 84
PREDEFINED NUMBER OF APPROVALS 86
USER ID
APPROVAL REQUIRED?
ADDITIONAL INFO 90
FILE A
FILE B
FILE C
FILE D
TOP
FILE A
FILE B
FILE A
2
3
2
4
USER1 ☒☐☐
USER2 ☒☐☐
USER3 ☒☐☐
USER6 ☒☒☐
USER2 ☐☐☒
USER4 ☐☐☐
USER5 ☒☐☐
USER7 ☐☒☐
88
REVIEWER 88(1)
REVIEWER 88(2)
94
APPROVED
REJECTED
APPROVED
REJECTED

FIG. 3

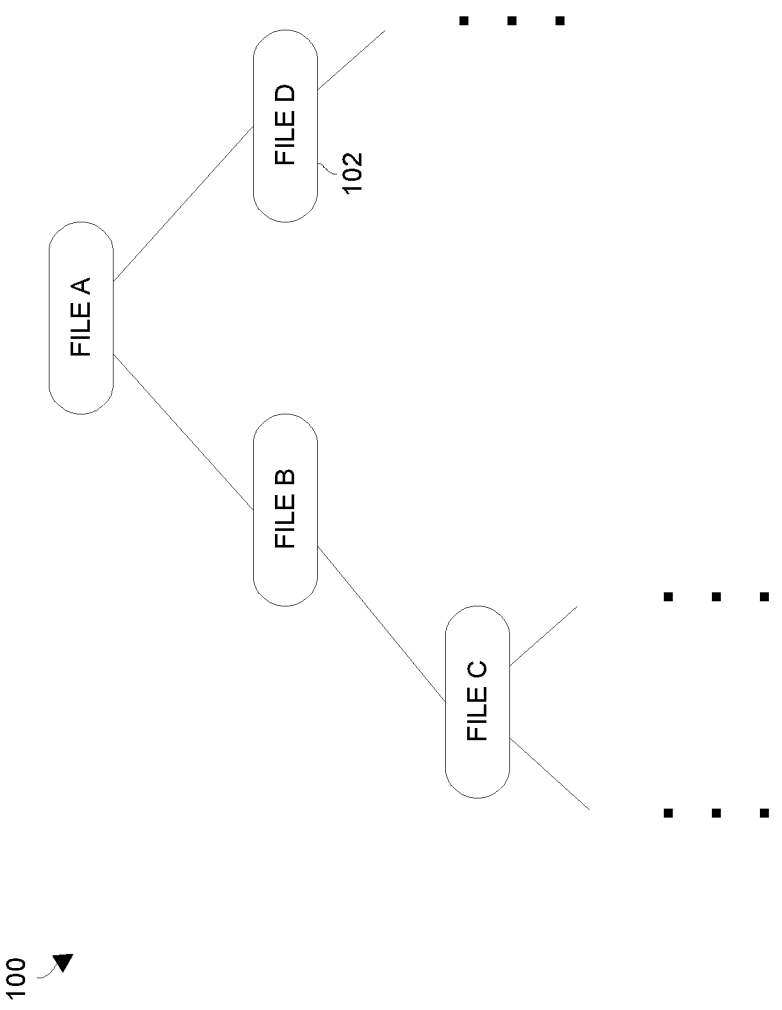

FIG. 4

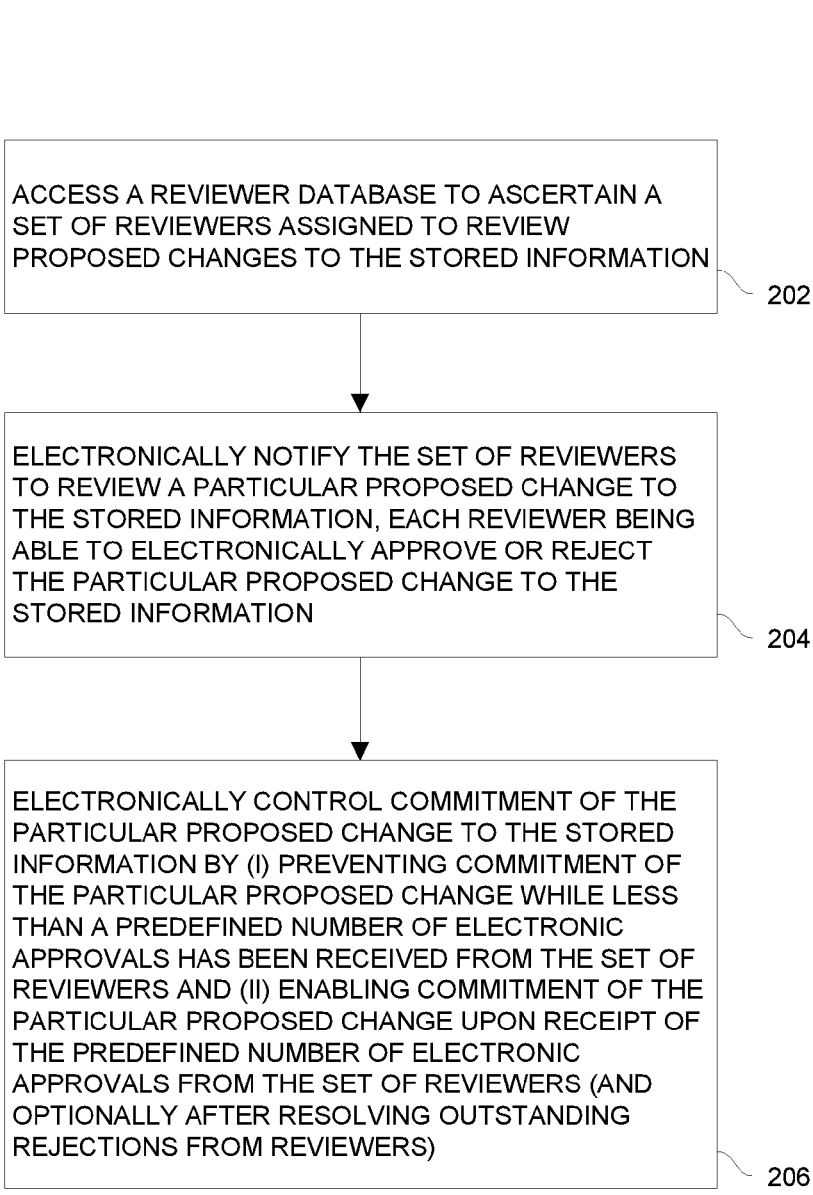
200
ACCESS A REVIEWER DATABASE TO ASCERTAIN A SET OF REVIEWERS ASSIGNED TO REVIEW PROPOSED CHANGES TO THE STORED INFORMATION
202
ELECTRONICALLY NOTIFY THE SET OF REVIEWERS TO REVIEW A PARTICULAR PROPOSED CHANGE TO THE STORED INFORMATION, EACH REVIEWER BEING ABLE TO ELECTRONICALLY APPROVE OR REJECT THE PARTICULAR PROPOSED CHANGE TO THE STORED INFORMATION
204
ELECTRONICALLY CONTROL COMMITMENT OF THE PARTICULAR PROPOSED CHANGE TO THE STORED INFORMATION BY (I) PREVENTING COMMITMENT OF THE PARTICULAR PROPOSED CHANGE WHILE LESS THAN A PREDEFINED NUMBER OF ELECTRONIC APPROVALS HAS BEEN RECEIVED FROM THE SET OF REVIEWERS AND (II) ENABLING COMMITMENT OF THE PARTICULAR PROPOSED CHANGE UPON RECEIPT OF THE PREDEFINED NUMBER OF ELECTRONIC APPROVALS FROM THE SET OF REVIEWERS (AND OPTIONALLY AFTER RESOLVING OUTSTANDING REJECTIONS FROM REVIEWERS)
206

FIG. 5

ELECTRONICALLY CONTROLLING COMMITMENT OF A CHANGE TO STORED INFORMATION

BACKGROUND

A conventional software development system provides a framework within which software developers can create and maintain a software application. For example, such a system typically enables multiple software developers to write and store source code of the software application, as well as manage, build and test different versions of the application based on that source code.

Along these lines, suppose that a software developer wishes to modify existing source code which resides in a particular file. Perhaps the software developer wishes to implement an enhancement to the application or fix a software bug. To modify the existing source code, the software developer typically exports or "checks out" a local copy of the particular file from the system and edits the source code in the local copy, e.g., on a software development workstation. Once the software developer finishes modifying the source code in the local copy, the software developer commits or "checks in" the modified source code into the system and the system responds by safely and reliably writing the modified source code back into the system.

Some conventional software development systems are equipped with a feature which enables software developers to inform each other when modified source code has been committed. In such a system, after the software developer commits modified source code back into the system, the system automatically informs the other software developers that the modified source code has been committed.

SUMMARY

Unfortunately, there are deficiencies to the above-described conventional software development system which automatically informs other software developers after modified source code has been committed. For example, the above-described conventional software development system does not provide any notice to the other software developers prior to software developers prior to commitment of the modified source code. That is, once the software developer commits the modified source code, it is too late for the other software developers to provide input and perhaps influence how the source code should have been modified. Nevertheless, in some situations, a review performed by the other software developers and/or a suggestion from another software developer as to how the source code should be modified could otherwise provide certain advantages. For instance, a review of the modified source code prior to commitment by another software developer could identify a bug in the modified source code and/or could result in discovery of a newly created problem which otherwise would not be discovered until after commitment of the modified source code.

In contrast to the above-described conventional software development system which automatically informs other software developers after modified source code has been committed, an improved technique involves electronically controlling commitment of a proposed change to stored information based on electronic approvals from a set of reviewers. Such a technique enables the set of reviewers (e.g., who are ascertained using a reviewer database) to approve or reject the proposed change prior to commitment of the proposed change. Accordingly, other reviewers now have opportunities to flag problems prior to commitment or perhaps even discover new issues which warrant further investigation prior to commitment. Such a technique is well suited for use as part of, or in combination with, a software development platform as well as other electronic systems.

One embodiment is directed to a method of electronically controlling commitment of a change to stored information. The method includes accessing a reviewer database to ascertain a set of reviewers assigned to review proposed changes to the stored information. The method further includes electronically notifying the set of reviewers to review a particular proposed change to the stored information after the set of reviewers is ascertained. Each reviewer is able to electronically approve or reject the particular proposed change to the stored information. The method further includes (i) electronically preventing commitment of the particular proposed change to the stored information while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enabling commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers (e.g., when a quorum is reached).

Another embodiment is directed to an electronic system which electronically controls commitment of a change to stored information. Another embodiment is directed to a computer program product for electronically controlling commitment of a change to stored information. Other embodiments are directed to apparatus, processes, articles of manufacturer, and so on.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages will be apparent from the following description of particular embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of various embodiments of the invention.

FIG. **1** is a block diagram of an electronic system which electronically controls commitment of a proposed change to stored information.

FIG. **2** is a block diagram of particular parts of an electronic server of the electronic system which participate in the commitment process.

FIG. **3** is an example of entries in a reviewer database of FIG. **2**.

FIG. **4** is an example hierarchy which is represented by the example entries of the reviewer database of FIG. **3**.

FIG. **5** is a flowchart of a procedure which is performed by the electronic server during the commitment process.

DETAILED DESCRIPTION

An improved technique involves electronically controlling commitment of a proposed modification to stored information based on electronic approvals from a set of reviewers (i.e., one or more reviewers). Such a technique enables each reviewer to approve or reject the proposed modification prior to commitment of the proposed modification, and commitment occurs only upon receipt of appropriate approval. As a result, reviewers are able to flag problems prior to commitment or perhaps even discover potential newly created issues which warrant further investigation prior to commitment. Such a technique is well suited for use as part of, or in combination with, a software development platform as well as other kinds of electronic systems.

FIG. **1** shows an electronic system **20** which electronically controls commitment of a proposed modification to stored information. The electronic system **20** includes a server device **22**, multiple client devices **24**(**1**), **24**(**2**), **24**(**3**), . . . (collectively, client devices **24**), and a communications medium **26**. By way of example only, some of the details below will be provided in the context of a software development platform. Nevertheless, it should be understood that the electronic system **20** is suitable for use in other types of applications which involve coordinating a proposed modification among multiple users.

As shown in FIG. **1**, the server device **22** includes a back-end data manager **30** and a front-end commitment controller **32**. The back-end data manager **30** is constructed and arranged to store information **34** (e.g., electronic data). The stored information **34** may exist as separate data elements (e.g., a collection of files) which together form a body of work or perhaps form different versions of the body of work. For example, in the context of a software development platform, the stored information **34** may include files which are suitable for building different versions of a software application, an operating system, parts of an operating system, and so on.

The front-end commitment controller **32** of the server device **22** is constructed and arranged to control commitment of proposed modifications **36** to the stored information **34**. For example, a user is able to save a proposed modification (or change) **36** on the server device **22**, and then activate the front-end commitment controller **32** to initiate a review process prior to commitment of the proposed change **36**. In response to such activation, the front-end commitment controller **32** sends a set of review notifications **40** to a set of reviewers and awaits a set of replies **42** from the set of reviewers. At this point, the reviewers are able to access and evaluate the proposed change **36** on the server device **22**. Each reply **42** may include approval (i.e., acceptance) of the proposed change **36** or perhaps other input (e.g., an expressed comment or concern, a question, a proposal for an alternative change, and so on). The front-end commitment controller **32** allows commitment of the change **36** upon receipt of a predefined number of reviewer approvals, and perhaps satisfaction of other requirements such as electronic approval from one or more designated people. In the meantime, the front-end commitment controller **32** does not permit commitment of the change **36**.

The client devices **24** (e.g., computerized workstations) are constructed and arranged to access the server device **22** for a variety of purposes. For example, a user on each client device **24** is capable of submitting a proposed change **36** to the stored information **34** and activating the front-end commitment controller **32** on the server device **22** to have the proposed change **36** reviewed (e.g., see the client device **24**(**1**)). Additionally, users on other client devices **24** are able to receive review notifications **40** from the server device **22**, evaluate the proposed change **36**, and return replies **42** approving/rejecting the proposed change **36** (e.g., see the client devices **24**(**2**), **24**(**3**)). In the context of a software development platform, users of the client devices **24** are thus able to effectively develop and build software applications using the server device **22** as a source code review and analysis platform as well as a formal repository for the source code and executables, among other things.

The communications medium **26** is constructed and arranged to convey communications **48** (i.e., electronic signals such as the notifications **40** and replies **42**) between the server device **22** and the client devices **24**. The communications medium **26** is illustrated as a cloud to indicate that the communications medium **26** is capable of having a variety of different topologies including backbone, hub-and-spoke, loop, irregular, combinations thereof, and so on. Along these lines, the communications medium **26** may include copper-based devices and cabling, fiber optic devices and cabling, wireless devices, combinations thereof, and so on. Moreover, some portions of the communications medium **26** may include a computer network (e.g., the Internet, a LAN, a VPN, etc.) while other portions may include a different type of network (e.g., SAN hardware, etc.).

During operation of the electronic system **20**, users working on the client devices **24** are able to reliably access and make use of the stored information **34** via the back-end data manager **30** of the server device **22** (e.g., to develop a software application). Furthermore, the front-end commitment controller **32** imposes discipline and structure to the process of making changes to the stored information **34** thus safeguarding the integrity of the stored information **34** but nevertheless enabling the users to coordinate their efforts at the same time.

It should be understood that the proposed change **36** may take a variety of different forms. For example, in the context of a software development platform, the user is able to initially create a remote working copy of at least some of the stored information **24** on a client device **24** (e.g., client device **24**(**1**)). The user then modifies the contents of the remote working copy (e.g., edits source code in a file, etc.). When the user is finished modifying the remote working copy and is then ready to enter the proposed modification **36** back into the server device **22**, the user uploads the working copy back onto the server device **22** and invokes the front-end commitment controller **32** which notifies a set of reviewers assigned to review and potentially approve the proposed modification **36** within the working copy for commitment. Preferably, the front-end commitment controller **32** sends each reviewer a separate notification message **40** indicating that the proposed modification **36** is ready for review (e.g., see client devices **24**(**2**) and **24**(**3**)).

In response to the notification messages **40**, the reviewers study the proposed modification **36** within the working copy and either approve or reject the proposed modification **36**. With the proposed modification **36** residing on the server device **22**, the reviewers are able to conveniently view and analyze the proposed modification **36** prior to to commitment. There is no need for the user to manually circulate the proposed change **36** in an ad hoc manner (i.e., in a manner which may be uncontrolled or poorly managed). Advantageously, the front-end commitment controller **32** does not allow commitment of the modified copy until the server device **22** receives, in the replies **42**, the predefined number of electronic approvals (e.g., a quorum). As a result, the reviewers are able to identify bugs, make suggestions for alternative modifications, and discover new problems prior to commitment of the proposed modification **36**.

As an alternative to receiving a modified working copy (e.g., a revised file) from a client device **24**, it should be understood that the server device **22** is also able to receive proposed changes **36** directly from the client devices **24**. In particular, the server device **22** is able to create a local working copy of at least part of the stored information **34** and allow a user (e.g., on client device **24**(**1**)) to modify the local working copy without requiring the user to provide storage for the working copy at the user's client device **24**. After the user is finished making changes to the working copy on the server device **22**, the user then directs the front-end commitment controller **32** to send out review notifications **40** to the other users (e.g., see client devices **24**(**2**), **24**(**3**)). Again, the server device **22** treats the modification in the local working copy as

a proposed modification **36** and does not formally enter the proposed modification **36** until it receives, in the replies **42**, the proper approvals.

In some arrangements, the front-end commitment controller **32** is implemented by a computer program product **50** which provides a set of instructions (e.g., executable code). In particular, the computer program product **50** includes a non-transitory computer readable storage medium that stores a set of instructions which, when run by a computer, cause the computer to operate as the front-end commitment controller **32** and perhaps other portions of the server device **22**. Suitable forms for such a non-transitory computer readable storage medium which delivers such a set of instructions in a non-volatile manner include CD-ROMs, DVDs, disk memory, tape memory, flash memory, and the like. Further details will now be provided with reference to FIG. **2**.

FIG. **2** shows particular details of the server device **22** which are involved in effectuating a change to the stored information **34**. As shown in FIG. **2**, the front-end commitment controller **32** includes a commitment control circuit **60**, a reviewer database **62**, and storage **64** to store proposed modifications **36** which are available for review. The commitment control circuit **60** may provide a web browser interface to enable the users to access the commitment control circuit **60** via web browsers. In some arrangements, the commitment control circuit **60** is formed by a network interface and a set of processors running the set of instructions delivered by the computer program product **50** (FIG. **1**). In other arrangements, the commitment control circuit **60** is formed by specialized hardware. Other arrangements are suitable as well.

The reviewer database **62** identifies the various data elements (e.g., files, portions of files, etc.) of the stored information **34**. For each data element, the reviewer database **62** includes particular items of information which the front-end commitment controller **32** uses to (i) identify particular reviewers who are authorized to approve changes **36** to that data element, as well as (ii) track the number of approvals received for a proposed modification **36** to that data element. The commitment control circuit **60** manages the reviewer database **62** and does not allow commitment of any proposed change **36** to a particular data element until the approval requirements for proposed changes **36** to that data element are satisfied.

As further shown in FIG. **2**, the back-end data manager **30** includes a data management subsystem **66** and managed storage **68** for reliably maintaining the stored information **34**. The managed storage **68** may include a data storage system (e.g., a single disk drive, a disk assembly, a storage array, etc.) having certain fault tolerance and high availability features (e.g., backups, redundancy, etc.). In some arrangements, the same data storage system which manages the stored information **34** may further provide the storage **64** for proposed modifications **36** as well as for the reviewer database **62**. The data management subsystem **66** preferably provides a change commit feature **70** which commits changes to the stored information **34**. This change commit feature **70** is under control of the commitment control circuit **60** of the front-end commitment controller **32**. Before Before walking through the various exchanges that occur between the parts of the server device **22** illustrated in FIG. **2**, a further description of the reviewer database **62** will be provided.

FIGS. **3** and **4** show further details of the reviewer database **62**. In particular, FIG. **3** shows entries **80**(A), **80**(B), **80**(C), **80**(D), . . . (collectively entries **80**) of the reviewer database **62**, and FIG. **4** shows a hierarchical diagram **100** of data elements **102** which is defined by the entries **80**. The commitment control circuit **60** updates the reviewer database **62** each time a new data element **102** is added to the stored information **34**, and each time a user invokes the review process in order to commit a proposed change **36** to the stored information **34**.

As shown in FIG. **3**, each entry **80** includes a component identifier (ID) field **82**, a parent ID field **84**, a predefined number of approvals field **86**, a set of reviewer fields **88**(**1**), **88**(**2**), . . . (collectively, reviewer fields **88**), and additional fields **90**. Each reviewer field **88** includes a variety of subfields **94** such as a user ID field, and requirement fields **94**. At an initial time and as the stored information **34** grows, an administrator (or automated process) adds new entries **80** to the reviewer database **62** and pre-populates at least some of the fields of the new entries **80** with appropriate data. The remaining fields of the new entries **80** are then populated during further operation of the electronic system **20**. A more-detailed description of the format for each entry **80** will now be provided.

For each entry **80**, the contents of the component ID field **82** identify a particular data element of the stored information **34** (i.e., a component ID). In the context of a software development platform, the component ID may be a filename of a particular file which forms part of a particular version of an application. Along these lines, when a file is initially added as part of the application or a version of the application, an administrator preferably creates an entry **80** identifying that file (e.g., by filename, pathname, combinations thereof, etc.) in the reviewer database **62**. By way of example, the contents of the component ID field **82** of entry **80**(B) identifies an electronic file of the stored information **34** named FILE B.

The contents of the parent ID field **84** of each entry **80** identify a data element of the stored information which is deemed a parent to the data element identified by the contents of the component ID field **82**. As a result, a hierarchical relationship between the two data elements is defined. In the context of the above-described software development platform, the contents of the parent ID field **84** of entry **80**(B) indicates that FILE B has FILE A as its parent. This relationship is illustrated graphically in FIG. **4**. In some arrangements, a software development system (e.g., see the data management system **66** in FIG. **2**) establishes this hierarchy and the commitment control circuit **60** is capable of extracting the relationship input directly from the software development system. It will be explained shortly that this dependency relationship enables a certain level of inheritance to exist.

The contents of the predefined number of approvals field **86** of each entry **80** indicates the predefined number of approvals required before the front-end commitment controller **32** (FIG. **2**) allows commitment of any proposed change **36** to the data element identified in the component ID field **82** of that entry **80**. In some arrangements, the predefined number of approvals must be at least two to ensure a disciplined, structured approach to the change review process. Here, a quorum of at least two approvals from reviewers is necessary before effectuating a change to the stored information. Of course, other numbers can be used depending on the particular situation (e.g., at least one reviewer approval, at least three reviewer approvals, and so on). In the context of the above-described software development platform, any proposed change **36** to FILE B requires at least three (3) reviewer approvals before the proposed change **36** can be committed.

The reviewer fields **88** of each entry **80** correspond to a set of users who are assigned to review any proposed changes **36** to the data element corresponding to that entry **80** and thus form a reviewer list for that data element. In particular, each reviewer field **88** includes a user ID subfield which identifies a particular user assigned to review proposed changes **36**, a

setting indicating whether approval from that user is a required prior to commitment, and approval/rejection input from that user. Preferably, each data element **80** element **80** is assigned at least one required reviewer (i.e., a primary user of authority) having primary responsibility for proposed changes **36** to that data element **80**. In the context of the above-described software development platform, USER2 and USER4 (perhaps among others) are assigned to review proposed changes **36** to FILE B, and approval from USER2 is required (a control box is checked or a control bit is set) before commitment of any proposed changes **36** to FILE B.

In some arrangements, user email addresses are suitable for use as the user IDs. Here, each user email address not only uniquely identifies a user, but also identifies a particular vehicle for communicating with that user. Alternative approaches for identifying users are suitable for use as well such as client device IDs, user login IDs, character strings, combinations thereof, and so on.

The contents of the additional info field **90** of each entry **80** is constructed and arranged to store additional information about the corresponding data element **102** (e.g., subfields for comments, descriptions, etc.). If a proposed change **36** has been submitted for review by a user, the additional info field **90** may include the user ID of that user and a short description of the proposed change **36**. The additional info field **90** may further include input from particular reviewers, timestamps of proposed change submissions and associated communications, a review and/or revision history, a list of child data elements **102**, and so on.

It should be understood that the entries **80** of the reviewer database **62** are constructed and arranged to depict a set of dependency relationships regarding how the stored information **34** is organized in the managed storage **68** by the data management subsystem **66** (also see FIG. **2**). In particular, as shown in FIG. **4**, the data elements **102** have parent/child relationships with other data elements **102** thus providing a file hierarchy in the form of an inverted tree. In the context of the above-described software development platform, FILE B and FILE D depend from FILE A. Additionally, FILE C depends from FILE B, and so on.

It should be understood that there may be multiple versions of each data element **102** (e.g., many different versions of a file for software development purposes), and that the reviewer database **62** is capable of tracking such versions. However, a single version of each data element is illustrated in FIG. **4** for simplicity.

In some arrangements, the existing hierarchical relationships are referenced for inheritance purposes when creating additional entries **80** in the reviewer database **62**. For example, suppose that an administrator wishes to add a new data element **102**, i.e., FILE E, as a child to FILE D. When the administrator creates a new entry **80**, the administrator indicates that the new entry **80** corresponds to FILE E and that FILE E is a child of FILE D. Accordingly, the commitment control circuit **60** of the front-end commitment controller **32** automatically copies (or provides a pointer/link) to the contents of fields **86**, **88** of the entry **80** for FILE D, i.e., entry **80**(D), to the fields **86**, **88** of the new entry **80** for FILE E. As a result, approval requirements for FILE D are inherited by FILE E (e.g., FILE E requires four (4) approvals, USER6 and USER7 are assigned as reviewers, and approval from USER **6** is required for change commitment, etc.). The administrator is then able to adjust the information in the fields for further customization.

With reference now to FIGS. **2** through **4**, a walk through of the exchange between the different parts of the server device **22** during the process of making a change to the stored information **34** will now be provided. In particular, suppose that a user wishes to commit a proposed change **36** to certain source code in FILE B (also see entry **80**(B) in FIG. **3**). To begin the review process, the user saves the proposed change **36** in a working copy **120** of FILE B in the storage **64** (illustrated by the arrow **120** in FIG. **2**). Alternatively, the proposed change **36** may take the form of a set of edit instructions, a portion of a file, a set of files, etc.

The user then sends a command **122** to the commitment control circuit **60** of the front-end commitment controller **32**. The command **122** includes the user ID (e.g., an email address) of the user, the component ID which identifies FILE B, and a short description of the proposed change **36**. In some arrangements, sending the command **122** includes filling out input cells of a webpage and hitting a submit button.

In response to the command **122**, the commitment control circuit **60** accesses the reviewer database **62** to ascertain a set of reviewers assigned to review the proposed change **36** to the stored information **34** (see arrow **124** in FIG. **2**). In the example, the commitment control circuit **60** determines that entry **80**(B) corresponds to FILE B (i.e., the contents of the component ID field **82** identifies FILE B). The commitment control circuit **60** then saves the information from the command **122** in the additional info field **90** of the entry **80**(B) and sends a set of notifications **40** to the set of reviewers identified by the set of reviewer fields **88** of the entry **80**(B). Namely, the commitment control circuit **60** sends, as notifications **40**, a separate email message to each reviewer: USER2, USER4, ... Each email message identifies the user, the particular data element **102** having the proposed change **36**, and a short description of the proposed change **36**, and so on.

The commitment control circuit **60** then awaits receipt of a set of responses **42** from the set of reviewers. In particular, each reviewer is capable of examining the proposed change **36** from the storage **64** and then returning a response **42** which accepts or rejects the proposed change **36**. Of course, it is possible for a reviewer to hold off providing a response **42** rather than reject the proposed change **36** such as when the reviewer needs to communicate with the user out of band to further understand the nature of the proposed change **36** and/or explore alternative changes. Advantageously, such collaboration is made possible since the proposed change **36** has not yet been committed to the stored information **34**.

While less than the predefined number of electronic approvals has been received from the set of reviewers, the commitment control circuit **60** electronically prevents commitment of the proposed change **36**. As the reviewers send their responses **42** back to the commitment control circuit **60**, the commitment control circuit **60** updates the entry **80**(B) in the reviewer database **62**. In particular, the commitment control circuit **60** fills in the subfield settings of the reviewer fields **88** and the additional info field **90** as each response **42** is collected. Additionally, each time the commitment control circuit **60** updates the entry **80**(B), the commitment control circuit **60** checks to see whether the approval requirements have been satisfied.

Upon receipt of the predefined number of electronic approvals from the set of reviewers and any required approvals, the commitment control circuit **60** electronically enables commitment of the proposed change **36** to the stored information **34**. Such enablement preferably takes the form of an electronic signal from the commitment control circuit **60** to the data management subsystem **66** (see arrow **126** in FIG. **2**). In some arrangements, the commitment control circuit **60** sets a bit or privilege parameter which now enables commitment of the proposed change **36**, e.g., unlocks a commitment feature of the data management subsystem **66**. In other arrange-

ments, the commitment control circuit **60** actually invokes a commitment feature of the data management subsystem **66** to commit the proposed change **36**.

To commit the proposed change **36**, the data management subsystem **66** updates the stored information **34** in the managed storage **68** based on the proposed change **36** (see arrow **128** in FIG. **2**). In some arrangements, the data management subsystem **66** effectuates the change by formally storing a new version of the file (e.g., FILE B) in the managed storage **68**. In the context of a software development platform, the data management subsystem **66** may commit multiple proposed changes **36** into the stored information **34** at the same time thus merging the changes as part of common entry. Further details will now be provided with reference to FIG. **5**.

FIG. **5** is a flowchart of a procedure **200** which describes the operation of the commitment control circuit **60** (FIG. **2**) when electronically controlling commitment of a proposed change **36** to the stored information **34**. To invoke the procedure **200**, a user uploads a proposed change **36** to the storage **64** and activates the commitment control circuit **60** (e.g., enters the command **122**, also see FIG. **2**).

In step **202**, the commitment control circuit **60** accesses the reviewer database **62** to ascertain a set of reviewers assigned to review proposed changes **36** to the stored information **34**. In particular, the commitment control circuit **60** locates the entry **80** corresponding to the data element **102** to be changed.

In step **204**, after the set of reviewers is ascertained, the commitment control circuit **60** electronically notifies the set of reviewers to review the proposed change **36**. Each Each reviewer is able to electronically examine the proposed change from the storage **64** and either approve or reject the particular proposed change **36** to the stored information **34**.

In step **206**, the commitment control circuit **60** (i) electronically prevents commitment of the particular proposed change **36** to the stored information **34** while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enables commitment of the particular proposed change **36** to the stored information **34** upon receipt of the predefined number of electronic approvals from the set of reviewers. In particular, as the reviewers provide their respective responses **42**, the commitment control circuit **60** updates the entry **80** and checks whether the approval requirements for the data element have been satisfied. Once the approval requirements have been met, the commitment control circuit **60** allows commitment of the proposed change **36** by signaling the data management subsystem **66** (see arrow **126** in FIG. **2**).

It should be understood that, although the procedure **200** explains that the commitment is essentially dictated by whether a predefined number of approvals has been received, other factors can be included as well. For example, based on settings in the reviewer fields **88** of the entry **80** (also see FIG. **3**), the commitment control circuit **60** may require one or more approvals from specific users (i.e., defined primary owners of the data element). Approvals from other users (i.e., secondary reviewers) may be required as well in order to obtain a quorum.

As mentioned above, an improved technique involves electronically controlling commitment of a proposed change **36** to stored information **34** based on electronic approvals from a set of reviewers. Such a technique enables the set of reviewers (e.g., who are ascertained using a reviewer database **62**) to approve or reject the proposed change **36** prior to commitment of the proposed change **36**. Accordingly, other reviewers now have opportunities to flag problems prior to commitment or perhaps even discover new issues which warrant further investigation prior to commitment. Such a technique is well suited for use as part of, or in combination with, a software development platform as well as other well as other electronic systems.

While various embodiments of the invention have been particularly shown and described, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

For example, the electronic system **20** was described above in the context of a software development platform for illustrative purposes. It should be understood that other applications are possible as well. Such applications for the electronic system **20** may include document drafting platforms, music mixing platforms, movie (video and audio) editing systems, and so on. Along these lines, the techniques disclosed above can be applied to scenarios which involve multiple users tasked with coordinating changes to a common body of work.

Additionally, in some arrangements, the front-end commitment controller **32** of the server device **22** prevents the user who submitted the proposed modification **36** (i.e., the submitter) from making any further changes while the proposed modification **36** is under review. To make further changes in these arrangements, the submitter directs the front-end commitment controller **32** to abort the review process, and the front-end commitment controller **32** responds by sending out new notification messages **40** notifying the reviewers that the submitter has canceled the proposed modification **36**. The submitter is then free to submit a new proposed modification **36** and start the review process again in a similar manner.

In other arrangements, the front-end commitment controller **32** is capable of accommodating further changes that the submitter makes while the review is in progress. In one arrangement, the submitter makes a further change and informs the front-end commitment controller **32** to send out new notification messages **40** to the reviewers thereby resetting the review process. In another arrangement, the front-end commitment controller **32** automatically detects when a new change is made, and then sends out new notification messages **40** instructing all reviewers to re-review.

Other "further change" alternatives are suitable as well. For instance, in yet another another arrangement, the front-end commitment controller **32** manages a sequence of review points. That is, after the front-end commitment controller **32** has issued a first set of notification messages **40** to the reviewers to review a first proposed modification **36** (e.g., review point A), the front-end commitment controller **32** can receive a second proposed modification **36** (e.g., review point B). The front-end commitment controller **32** waits until it has received reviews for the first proposed modification **36** (i.e., review point A) before automatically issuing a second set of notification messages **40** to the reviewers to review the second proposed modification **36**. The front-end commitment controller **32** allows commitment of the proposed modifications **36** only after it receives an appropriate number of approvals for all outstanding review points.

Furthermore, the front-end commitment controller **32** is capable of concurrently coordinating proposed modifications **36** from multiple users. For example, suppose that User A makes a first proposed modification **36** to a file and directs the front-end commitment controller **32** to send out a first set of notification messages **40** to the reviewers. Then, suppose that User B makes a change to the same file and directs the front-end commitment controller **32** to send out a second set of notification messages **40** to the reviewers. In this situation, User B's file may not include the first proposed modification **36** from User A. Nevertheless, the front-end commitment controller **32** is able to handle this situation by allowing

commitment of the first proposed modification **36** by User A once appropriate approvals for the first proposed modification **36** is received. The front-end commitment controller **32** then directs User B to absorb/merge User A's changes into User B's file and then issues a new set of notification messages **40** to the reviewers to review the second proposed modification **36**. Such operation treats the second proposed modification **36** by User B as a new review point which is capable of being approved and committed via an updated review.

Additionally, by way of example only, the reviewer database **62** was described above as being separate from the managed storage **68** which holds the stored information **34** (e.g., see FIG. **2**). However, in other arrangements, proposed modifications **36** to the reviewer database **62** undergo review and are subject to the approval/rejection process, i.e., i.e., the reviewer database **62** is part of the stored information **34**. In these arrangements, when a new file is added and a commit request comes up, the front-end commitment controller **32** sends a request to the submitter to define reviewers. The submitter then identifies a set of reviewers to the front-end commitment controller **32**. Along these lines, the submitter may choose reviewers by requesting experts via the electronic system **20**, may communicate with potential reviewers out of band, may simply enter names based on his/her own knowledge, etc. The front-end commitment controller **32** then processes the submitter's choices of reviewers using the above-described review process. That is, the reviewer database **62** itself has reviewers (a primary owner, one or more secondary reviewers, and so on) and they must review/approve proposed modifications **36** to the reviewer database **62**.

Furthermore, by way of example only, the hierarchy of the information within the reviewer database **62** was described above as being defined by an administrator (e.g., see FIGS. **3** and **4**). However, in other arrangements, the reviewer database **62** is capable of inheriting information directly from the stored information **34** in the managed storage **68** (FIG. **2**). Along these lines, the hierarchy of the stored information **34** in the managed storage **68** establishes the hierarchy of the entries **80** in the reviewer database **62**. That is, the parent/child relationships for the entries **80** logically flows from the stored information **34** due to the inherent correspondence between the entries **80** and the stored information **34** (i.e., the entries **80** simply assume or mimic the relationships from the stored information). Moreover, a reviewer for Directory A is capable of being automatically designated as a reviewer for all subdirectories and all files in Directory A (but not limited to or not excluding others). Such operation enables the reviewer database **62** to be handled as a self-regulated body of stored information **34**.

Additionally, it should be understood that the submitter of a proposed modification **36** to a particular data element **102** may be listed in the reviewer database **62** as a reviewer for that data element **102**. In some arrangements, the commitment control circuit **60** handles this situation by excluding the submitter as a reviewer.

Furthermore, it was described above that, when the commitment control circuit **60** creates a new entry **80** for a new data element **102** in the reviewer database **62**, the commitment control circuit **60** is able to navigate up within the reviewer database **62** to copy the reviewer list from the entry **80** which corresponds to a parent data element **102** of the new data element **102** (see the reviewer fields **88** in FIG. **3**). Once the commitment control circuit **60** finds the entry **80** which corresponds to the parent data element **102**, the commitment control circuit **60** copies the reviewer list from the entry **80** which corresponds to the parent data element **102** so that the new entry **80** corresponding to the new data element **102** inherits this parent reviewer list. In some arrangements, this feature is recursive in that, if no parent review list is available for the parent data element **102**, the commitment control circuit **60** navigates further up the hierarchy to find an inheritable review list. As a result, the new data element **102** is capable of reliably inheriting a higher level reviewer list from a higher level data element **102** (i.e., a parent, a grandparent, and so on).

Additionally, it should be understood that the commitment control circuit **60** offers great flexibility and customization capabilities to the review process. For example, the commitment control circuit **60** is capable of managing a rejection tolerance using the reviewer database **62** (e.g., see the additional info fields **90** in FIG. **3**). Along these lines, the commitment control circuit **60** may prevent commitment of a proposed modification **36** as long as there is at least one reviewer who has rejected the proposed modification **36**. In such arrangements, the commitment control circuit **60** only allows commitment of the proposed modification **36** only after (i) the submitter has addressed all outstanding rejections so that the reviewers who initially rejected the proposed modification **36** have now removed their rejections (e.g., enabled by an optional setting in the additional info field **90**, FIG. **3**) and (ii) the appropriate approvals have been received.

In other arrangements, the commitment control circuit **60** allows commitment of the proposed modification **36** provided that the appropriate approvals have been received (e.g., from a designated primary reviewer and other reviewers) regardless of whether there are any rejections from reviewers. In yet other arrangements, commitment control circuit **60** requires all reviewers to review (and perhaps comment on the proposed modification modification **36**), and the commitment decision is based on a managed vote (e.g., a ratio of approvals and rejections) thus enabling a certain number of approvals (N) to override one or more rejections. Other scenarios are suitable for use as well.

Additionally, it should be understood that the client devices **24** were described above as including general computerized workstations (e.g., desktop computers, laptops, etc.) which run applications to enable the users to edit. In some arrangements, the client devices **24** may include specialized hardware such as sophisticated special effects and mixing equipment, and so on.

Furthermore, it should be understood that the data elements **102** which are handled by the electronic system **20** were described as electronic files by way of example. In other arrangements, the data elements **102** take other forms such as portions of files, sets of files, audio or video clips, data modules, blocks, etc. For example, in the context of a software development platform, the component IDs may refer to software modules or larger bodies of software having subparts rather than files, and the entries **80** can correspond to these modules. As another example, the commitment control circuit **60** is capable of coordinating approvals for multiple components/files (e.g., by coordinating multiple entries **80** in the reviewer database **62**) so that commitment of the proposed changes to the multiple components/files occurs only after appropriate approvals for all components/files are received.

Additionally, it should be understood that the identifiers illustrated above were provided by way of example only. In particular, the values for the component IDs were described above as filenames and/or pathnames, and the user IDs were described above as email addresses. In other arrangements, the IDs take other forms such as unique numerical identifiers, reference IDs received from the data management subsystem **66**, character strings, etc.

Furthermore, it should be understood that the reviewer database **62** may operate as a tracking and workflow tool that saves a history of change reviews over time as well as guides testing and release of the particular changes. Along these lines, the additional info fields **90** of the entries **80** (FIG. **3**) can be configured to store the change history of the various data elements. Additionally, the additional info fields **90** can define and track particular checks and tests that the data elements must pass before being deemed acceptable (e.g., "demo ready"). Such modifications and enhancements are intended to belong to particular embodiments.

What is claimed is:

1. A method of electronically controlling commitment of a change to stored information, the method comprising:

accessing a reviewer database to ascertain a set of reviewers assigned to review proposed changes to the stored information, the stored information being a portion of source code stored in a source code file, the source code having been previously compiled into operable executable code, the portion of source code being a portion of a software application;

after the set of reviewers is ascertained, electronically notifying the set of reviewers to review a particular proposed change to the stored information, the particular proposed change being constructed and arranged to modify operation of the operable executable code, each reviewer being able to electronically approve or reject the particular proposed change to the stored information in parallel with other reviewers of the set of reviewers for concurrent review coordination of the particular proposed change; and

(i) electronically preventing commitment of the particular proposed change to the stored information while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enabling commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers;

prior to committing the particular proposed change to the stored information, accessing the reviewer database to ascertain another set of reviewers assigned to review another proposed change to another portion of the source code which has been previously compiled into the operable executable code;

in response to the particular proposed change to the stored information being electronically committed and determining that the particular proposed change and the other proposed change work together, automatically notifying a drafter of the other proposed change to merge the particular proposed change with the other proposed change and then notifying the other set of reviewers to review the other proposed change to the other portion of the source code, each reviewer of the other set of reviewers being able to electronically approve or reject the other proposed change to the stored information in parallel with other reviewers of the other set of reviewers for concurrent review coordination of the other proposed change;

wherein the operable executable code forms a portion of a prior version of an executable application; and

wherein the method further comprises, after commitment of the particular proposed change to the stored information is electronically enabled by receipt of the predefined number of electronic approvals from the set of reviewers, compiling and linking the source file along with other source files to generate a new version of the executable application which is different than the prior version of the executable application.

2. A method as in claim **1** wherein the reviewer database includes database entries corresponding to various data components, the stored information being a particular data component; and wherein accessing the reviewer database to ascertain the set of reviewers includes:

receiving an electronic change request from a user, the electronic change request including a particular data component identifier,

selecting a particular database entry among the database entries based on the particular data component identifier, and

in response to selection of the particular database entry, obtaining an electronic reviewer list which lists the set of reviewers.

3. A method as in claim **2** wherein the electronic reviewer list includes a set of user identifiers which identify respective reviewers of the set of reviewers; and

wherein electronically notifying the set of reviewers to review the proposed change to the stored information includes, based on the set of user identifiers, providing separate electronic notifications to the respective reviewers of the set of reviewers.

4. A method as in claim **3** wherein a format for the database entries includes (i) a current data component field for identifying a current data component, (ii) a reviewer list field for listing reviewers of the current data component; and (iii) a parent data component field for identifying a parent data component of the current data component; and

wherein the method further comprises populating the database entries of the reviewer database to hierarchically relate the various data components to each other.

5. A method as in claim **4** wherein obtaining the electronic reviewer list in response to selection of the particular database entry includes:

accessing a first database entry corresponding to the particular data component;

when a reviewer list field of the first database entry references a reviewer list, processing contents of the reviewer list field of the first database entry to acquire the electronic reviewer list; and

when the reviewer list field of the first database entry does not reference a reviewer list, processing contents of a reviewer list field of a second database entry of the reviewer database to acquire the electronic reviewer list, the second database entry corresponding to a data component which is at a higher level relative to the particular data component.

6. A method as in claim **3** wherein the predefined number of electronic approvals is at least two;

wherein the set of user identifiers of the electronic reviewer list includes at least one primary user identifier which identifies at least one primary reviewer of the particular data component and at least one second user identifier which identifies at least one secondary reviewer of the particular data component; and

wherein electronically enabling commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers includes receiving at least one approval from at least one primary reviewer.

7. A method as in claim **3** wherein providing separate electronic notifications to the respective reviewers of the set of reviewers includes:

sending a separate email message to each respective reviewer of the set of reviewers, the separate email messages including a common description of the particular proposed change.

8. A method as in claim **3**, further comprising:

providing a web browser interface to receive input from the set of reviewers; and

maintaining a tally of electronic approvals and rejections based on the input from the set of reviewers.

9. A method as in claim **3** wherein electronically preventing commitment and electronically enabling commitment of the particular proposed change includes:

setting an enable/disable parameter to prohibit issuance of a commit command to a back-end application while less than the predefined number of electronic approvals has been received from the set of reviewers and adjusting the enable/disable parameter to allow issuance of the commit command to the back-end application upon receipt of the predefined number of electronic approvals from the set of reviewers.

10. A method as in claim **9** wherein the back-end application is a software development platform;

wherein the various data components are portions of software under development which is stored in a data storage system; and

wherein the method further comprises, after the enable/disable parameter is adjusted to allow issuance of the commit command to the back-end application, providing the commit command to the back-end application to commit the particular proposed change to the software under development which is stored in the data storage system.

11. A method as in claim **1** wherein electronically notifying the set of reviewers to review the particular proposed change to the stored information includes informing the set of reviewers to review a first proposed modification to the source code file from a submitter; and wherein the method further comprises:

after informing the set of reviewers to review the first proposed modification to the source code file from the submitter and prior to electronically enabling commitment, restarting review by re-informing the set of reviewers to review a second proposed modification to the source code file from the submitter.

12. A method as in claim **1** wherein electronically notifying the set of reviewers to review the particular proposed change to the stored information includes informing the set of reviewers to review a first proposed modification to the source code file from a first submitter; and wherein the method further comprises:

after informing the set of reviewers to review the first proposed modification to the source code file from the first submitter, (i) receiving a second proposed modification to the source code file from a second submitter, (ii) receiving the predefined number of electronic approvals from the set of reviewers in response to informing the set of reviewers to review the first proposed modification to the source code file from the first submitter, and then (iii) informing the set of reviewers to review the second proposed modification to the source code file from the second submitter prior to electronically enabling commitment.

13. Apparatus to electronically control commitment of a change to stored information, the apparatus comprising:

a communications interface;

a non-transitory computer readable memory device which stores a reviewer database; and

a control circuit coupled to the communications interface and the non-transitory computer readable memory device, the control circuit being constructed and arranged to:

access the reviewer database stored in the non-transitory computer readable memory device to ascertain a set of reviewers assigned to review proposed changes to the stored information, the stored information being a portion of source code stored in a source code file, the source code having been previously compiled into operable executable code, the portion of source code being a portion of a software application;

after the set of reviewers is ascertained, electronically notify the set of reviewers through the communications interface to review a particular proposed change to the stored information, the particular proposed change being constructed and arranged to modify operation of the operable executable code, each reviewer being able to electronically approve or reject the particular proposed change to the stored information in parallel with other reviewers of the set of reviewers for concurrent review coordination of the particular proposed change, and

(i) electronically prevent commitment of the particular proposed change to the stored information while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enable commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers;

prior to committing the particular proposed change to the stored information, access the reviewer database to ascertain another set of reviewers assigned to review another proposed change to another portion of the source code which has been previously compiled into the operable executable code;

in response to the particular proposed change to the stored information being electronically committed and determining that the particular proposed change and the other proposed change work together, automatically notify a drafter of the other proposed change to merge the particular proposed change with the other proposed change and then notify the other set of reviewers to review the other proposed change to the other portion of the source code, each reviewer of the other set of reviewers being able to electronically approve or reject the other proposed change to the stored information in parallel with other reviewers of the other set of reviewers for concurrent review coordination of the other proposed change;

wherein the operable executable code forms a portion of a prior version of an executable application; and

wherein the method further comprises, after commitment of the particular proposed change to the stored information is electronically enabled by receipt of the predefined number of electronic approvals from the set of reviewers, compiling and linking the source file along with other source files to generate a new version of the executable application which is different than the prior version of the executable application.

14. Apparatus as in claim **13** wherein the reviewer database includes database entries corresponding to various data components, the stored information being a particular data component; and wherein the control circuit, when accessing the reviewer database to ascertain the set of reviewers, is constructed and arranged to:

receive an electronic change request from a user, the electronic change request including a particular data component identifier,

select a particular database entry among the database entries based on the particular data component identifier, and

in response to selection of the particular database entry, obtain an electronic reviewer list which lists the set of reviewers.

15. Apparatus as in claim **14** wherein the electronic reviewer list includes a set of user identifiers which identify respective reviewers of the set of reviewers; and

wherein the control circuit, when electronically notifying the set of reviewers to review the proposed change to the stored information, is constructed and arranged to:

based on the set of user identifiers, provide separate electronic notifications to the respective reviewers of the set of reviewers.

16. Apparatus as in claim **15** wherein the control circuit, when electronically preventing commitment and electronically enabling commitment of the particular proposed change, is constructed and arranged to:

set an enable/disable parameter to prohibit issuance of a commit command to a back-end application while less than the predefined number of electronic approvals has been received from the set of reviewers and adjust the enable/disable parameter to allow issuance of the commit command to the back-end application upon receipt of the predefined number of electronic approvals from the set of reviewers.

17. Apparatus as in claim **16** wherein the back-end application is a software development platform;

wherein the various data components are portions of software under development which is stored in a data storage system; and

wherein the control circuit is further constructed and arranged to:

after the enable/disable parameter is adjusted to allow issuance of the commit command to the back-end application, provide the commit command to the back-end application to commit the particular proposed change to the software under development which is stored in the data storage system.

18. A computer program product having a non-transitory computer readable storage medium which stores a set of instructions to electronically control commitment of a change to stored information; the set of instructions, when carried out by a computer, causing the computer to:

access a reviewer database to ascertain a set of reviewers assigned to review proposed changes to the stored information, the stored information being a portion of source code stored in a source code file, the source code having been previously compiled into operable executable code, the portion of source code being a portion of a software application;

after the set of reviewers is ascertained, electronically notify the set of reviewers to review a particular proposed change to the stored information, the particular proposed change being constructed and arranged to modify operation of the operable executable code, each reviewer being able to electronically approve or reject the particular proposed change to the stored information in parallel with other reviewers of the set of reviewers for concurrent review coordination of the particular proposed change; and

(i) electronically prevent commitment of the particular proposed change to the stored information while less than a predefined number of electronic approvals has been received from the set of reviewers and (ii) electronically enable commitment of the particular proposed change to the stored information upon receipt of the predefined number of electronic approvals from the set of reviewers;

prior to committing the particular proposed change to the stored information, accessing the reviewer database to ascertain another set of reviewers assigned to review another proposed change to another portion of the source code which has been previously compiled into the operable executable code;

in response to the particular proposed change to the stored information being electronically committed and determining that the particular proposed change and the other proposed change work together, automatically notifying a drafter of the other proposed change to merge the particular proposed change with the other proposed change and then notifying the other set of reviewers to review the other proposed change to the other portion of the source code, each reviewer of the other set of reviewers being able to electronically approve or reject the other proposed change to the stored information in parallel with other reviewers of the other set of reviewers for concurrent review coordination of the other proposed change;

wherein the operable executable code forms a portion of a prior version of an executable application; and

wherein the method further comprises, after commitment of the particular proposed change to the stored information is electronically enabled by receipt of the predefined number of electronic approvals from the set of reviewers, compiling and linking the source file along with other source files to generate a new version of the executable application which is different than the prior version of the executable application.

19. A computer program product as in claim **18** wherein the reviewer database includes database entries corresponding to various data components, the stored information being a particular data component; and wherein the set of instructions, when causing the computer to access the reviewer database to ascertain the set of reviewers, cause the computer to:

receive an electronic change request from a user, the electronic change request including a particular data component identifier,

select a particular database entry among the database entries based on the particular data component identifier, and

in response to selection of the particular database entry, obtain an electronic reviewer list which lists the set of reviewers.

20. A computer program product as in claim **19** wherein the electronic reviewer list includes a set of user identifiers which identify respective reviewers of the set of reviewers; and

wherein the set of instructions, when causing the computer to electronically notify the set of reviewers to review the proposed change to the stored information, cause the computer to, based on the set of user identifiers, provide separate electronic notifications to the respective reviewers of the set of reviewers.

21. A computer program product as in claim **20** wherein the set of instructions, when causing the computer to electronically prevent commitment and electronically enabling commitment of the particular proposed change, cause the computer to:

set an enable/disable parameter to prohibit issuance of a commit command to a back-end application while less

than the predefined number of electronic approvals has been received from the set of reviewers and adjust the enable/disable parameter to allow issuance of the commit command to the back-end application upon receipt of the predefined number of electronic approvals from the set of reviewers.

22. A computer program product as in claim **21** wherein the back-end application is a software development platform;

wherein the various data components are portions of software under development which is stored in a data storage system; and

wherein the set of instructions further cause the computer to, after the enable/disable parameter is adjusted to allow issuance of the commit command to the back-end application, provide the commit command to the back-end application to commit the particular proposed change to the software under development which is stored in the data storage system.

23. A method as in claim **1** wherein accessing a reviewer database to ascertain a set of reviewers assigned to review proposed changes to the stored information further comprises accessing a set of concurrent proposed modifications from multiple users to a file and coordinating commitment approval review of the set of concurrent proposed changes by accessing the reviewer database to ascertain multiple sets of reviewers.

24. A method as in claim **23** wherein each one of the multiple sets of reviewers is selected to review one of the set of concurrent proposed modifications.

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